

TRANSMITTAL LETTER TO THE UNITED STATES
DESIGNATED/ELECTED OFFICE (DO/EO/US)
CONCERNING A FILING UNDER 35 U.S.C. 371

66386-271-7

U.S. APPLICATION NO (IF KNOWN, SEE 37 CFR

09/914327

INTERNATIONAL APPLICATION NO.

PCT/DK00/00094

INTERNATIONAL FILING DATE

7 March 2000

PRIORITY DATE CLAIMED

8 March 1999

TITLE OF INVENTION

A METHOD AND AN APPARATUS FOR MEASURING ICING

APPLICANT(S) FOR DO/EO/US

NIELSEN, Evan

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☒ This is an express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371 (c) (2))
 - a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☒ has been transmitted by the International Bureau.
 - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☐ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☒ A copy of the International Search Report (PCT/ISA/210).
8. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))
 - a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☐ have been transmitted by the International Bureau.
 - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
 - d. ☐ have not been made and will not be made.
9. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
10. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).
11. ☒ A copy of the International Preliminary Examination Report (PCT/IPEA/409).
12. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).

Items 13 to 20 below concern document(s) or information included:

13. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98
14. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
15. ☒ A **FIRST** preliminary amendment.
16. ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
17. ☐ A substitute specification.
18. ☐ A change of power of attorney and/or address letter.
19. ☐ Certificate of Mailing by Express Mail
20. ☐ Other items or information:

Copy of WO 00/54078, dated 14 September 2000

U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR 1.53) 09/914327	INTERNATIONAL APPLICATION NO. PCT/DK00/00094	ATTORNEY'S DOCKET NUMBER 66386-271-7
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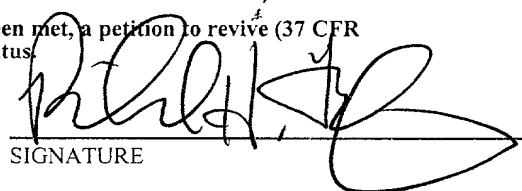
21. The following fees are submitted: BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) :				CALCULATIONS PTO USE ONLY	
<input type="checkbox"/> Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2)) paid to USPTO and International Search Report not prepared by the EPO or JPO \$1,000.00					
<input checked="" type="checkbox"/> International preliminary examination fee (37 CFR 1.482) not paid to USPTO but International Search Report prepared by the EPO or JPO \$860.00					
<input type="checkbox"/> International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO \$710.00					
<input type="checkbox"/> International preliminary examination fee paid to USPTO (37 CFR 1.482) but all claims did not satisfy provisions of PCT Article 33(1)-(4) \$690.00					
<input type="checkbox"/> International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1)-(4) \$100.00					
ENTER APPROPRIATE BASIC FEE AMOUNT =				\$860.00	
Surcharge of \$130.00 for furnishing the oath or declaration later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492 (e))				\$0.00	
CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	23 - 20 =	3	x \$18.00	\$54.00	
Independent claims	2 - 3 =	0	x \$80.00	\$0.00	
Multiple Dependent Claims (check if applicable)			<input type="checkbox"/>	\$0.00	
TOTAL OF ABOVE CALCULATIONS =				\$914.00	
Reduction of 1/2 for filing by small entity, if applicable. Verified Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28) (check if applicable).				<input type="checkbox"/>	\$0.00
SUBTOTAL =				\$914.00	
Processing fee of \$130.00 for furnishing the English translation later than <input type="checkbox"/> 20 <input type="checkbox"/> 30 months from the earliest claimed priority date (37 CFR 1.492 (f)).				\$0.00	
TOTAL NATIONAL FEE =				\$914.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) (check if applicable).				<input type="checkbox"/>	\$0.00
TOTAL FEES ENCLOSED =				\$914.00	
				Amount to be refunded	\$
				charged	\$

☐ A check in the amount of _____ to cover the above fees is enclosed.

☒ Please charge my Deposit Account No. **04-2223** in the amount of **\$914.00** to cover the above fees.
A duplicate copy of this sheet is enclosed.

☒ The Commissioner is hereby authorized to charge any fees which may be required, or credit any overpayment to Deposit Account No. **04-2223** A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

<p>SEND ALL CORRESPONDENCE TO:</p> <p>Richard H. Tushin, Esq. Registration No. 27,297</p>  <p>25269 PATENT TRADEMARK OFFICE</p>	<p></p> <p>SIGNATURE</p> <p>Richard H. Tushin</p> <p>NAME</p> <p>27,297</p> <p>REGISTRATION NUMBER</p> <p>August 27, 2001</p> <p>DATE</p>
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66386-271-7

J000 Rec'd PCT/TO 27 AUG 2001

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of:)	PATENT
)	
Evan NIELSEN)	Group: Unknown
)	
Serial No: (PCT/DK00/00094))	Examiner: Unknown
)	
Filed: Concurrently herewith)	
)	
A METHOD AND AN APPARATUS)	
FOR MEASURING ICING)	

* * * * *
PRELIMINARY AMENDMENT

Washington, D.C.
August 27, 2001

Honorable Director for Patents
Washington, D.C. 20231

Sir:

Concurrently with the U.S. national phase filing of this
application, please amend this application as follows:

IN THE CLAIMS:

Please amend claims 1, 4, 6-7, 10-12, 15-18, 20 and 22 as
follows. A marked-up copy of the claims, showing the changes made
thereto, is attached.

1. (Amended) A method for local measurement of an icing
factor for atmospheric air containing supercooled water, the method
comprising the following process steps:

providing at least one surface element (3) that is made of a material suitable for ice in atmospheric air to freeze on, said element having a predetermined surface area;

bringing the surface element(s) to a temperature that corresponds essentially to the temperature of the atmospheric air;

subsequently creating a relative movement at a predetermined velocity between the atmospheric air and the surface element(s) by allowing the surface element(s) to move through the atmospheric air, and for a predetermined period of time; and

subsequently measuring the thickness or mass of the ice frozen fast to the surface element(s) by means of a measurement device configured therefore after said predetermined period of time.

4. (Amended) A method according to claim 1, wherein a cover is provided that in a first position extends at least across the surface element(s), and covers and shields the surface element(s); and said cover being removed from the surface element(s) at least for the predetermined period of time during which the surface element s) is/are moved through the atmospheric air at a predetermined rate.

6. (Amended) A method according to claim 1, wherein the surface element(s) are caused to move through the atmospheric air at a velocity that ensures that atmospheric precipitation not frozen fast onto the surface element(s) is substantially thrown off the surface element(s).

7. (Amended) A method according to claim 1, wherein at least two surface elements are used that are rotatably arranged on a rotor shaft; and that the movement of the two surface elements is accomplished by a rotation of the rotor shaft.

10. (Amended) An apparatus according to claim 9, comprising means for heating the surface element(s).

11. (Amended) An apparatus according to claim 10, wherein the apparatus comprises a rotor element with a rotor shaft (2), and at least two surface elements (3) that extend from the rotor shaft and protrude there from, and wherein means (4) are provided for rotating the rotor about its axis.

12. (Amended) An apparatus according to claim 11, wherein the apparatus comprises a cover (6) whose inside faces towards the surface elements and which is configured for occupying a first position in which it extends across the surface element(s) that is/are hereby covered upwardly, and a second position in which the cover is removed and does not cover the surface element(s).

15. (Amended) An apparatus according to claim 14, wherein the apparatus is configured for moving the surface element(s) for a predetermined period of time after the cover (6) has, following a measurement procedure, reverted to its first position, whereupon the thickness or mass of ice frozen fast can be determined.

16. (Amended) An apparatus according to claim 15, wherein the cover is, in its second position, positioned such that its inside is substantially protected against atmospheric precipitation and consequently remains dry.

17. (Amended) An apparatus according to claim 16, wherein the surface element(s) each consists of a plate having a front (13) and a back (14) oriented opposite thereto, and wherein the plate is configured in such a manner that the front of the plate faces in the direction in which the respective surface element is moved through the atmospheric air, and wherein - through the plate - a plurality of passageways (1) extend from the front of the plate to its back such that the atmospheric air is allowed to flow through the passageways from the front of the plate to the back of the plate.

18. (Amended) An apparatus according to claim 17, wherein the apparatus comprises a system of surface elements (21, 22, 23, 24) mounted on a rotatable shaft (2) configured for being positioned in an essentially vertical position; and wherein the individual surface elements are configured and arranged such that the individual surface elements, corresponding to their projection on a face perpendicular to the rotatable shaft, abuts on or overlaps other surface elements, whereby it is accomplished that there is no space between the individual surface elements when the apparatus is viewed from above, and thus that all atmospheric precipitation falling

within the expanse of the apparatus, when the rotatable shaft is positioned vertically, essentially hits the surface elements and is thus able to settle in the form of ice.

20. (Amended) An apparatus according to claim 19, wherein the surface elements are configured with passageways; and that the apparatus comprises means such that air can be conveyed through the passageways.

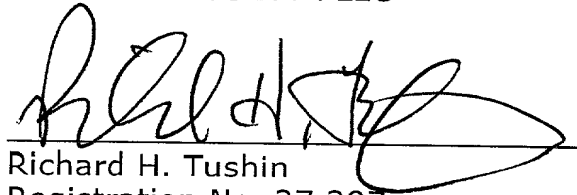
22. (Amended) An apparatus according to claim 21, wherein the apparatus is arranged at ground level in an airport; and that the apparatus comprises means for recording the measurement results for the thickness or mass of the ice deposited on the surface element(s), and means for visually or auditively emitting a signal to the monitoring personnel about the measurement result.

REMARKS

By this Preliminary Amendment claim 1 has been amended to better comply with U.S. practice and claims 4, 6-7, 10-12, 15-18, 20 and 22 have been amended to depend from only one preceding claim. Entry is requested.

Respectfully submitted,

DYKEMA GOSSETT PLLC

A handwritten signature in black ink, appearing to read 'Richard H. Tushin', is written over a horizontal line.

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RHT/jjr

ID 42063

VERSION WITH MARKINGS TO SHOW CHANGES
MADE TO CLAIMS

PCT/DK00/00094

1. (Amended) A method for local measurement of an icing factor for atmospheric air containing supercooled water, the method comprising the following process steps:

[wherein] providing at least one surface element (3) [is provided] that is made of a material suitable for ice in atmospheric air to freeze on, said element having a predetermined surface area;

[wherein] bringing the surface element(s) [is/are brought] to a temperature that corresponds essentially to the temperature of the atmospheric air;

[wherein] subsequently creating a relative movement at a predetermined velocity [is subsequently created] between the atmospheric air and the surface element(s) by allowing the surface element(s) to move through the atmospheric air, and for a predetermined period of time; and

[and wherein] subsequently measuring the thickness or mass of the ice frozen fast to the surface element(s) [is subsequently measured] by means of a measurement device configured therefore after said predetermined period of time.

4. (Amended) A method according to [any one of the preceding claims] claim 1, wherein a cover is provided that in a first position extends at least across the surface element(s), and covers and shields the surface element(s); and said cover being removed from the surface

element(s) at least for the predetermined period of time during which the surface element(s) is/are moved through the atmospheric air at a predetermined rate.

6. (Amended) A method according to [any one of the preceding claims] claim 1, wherein the surface element(s) are caused to move through the atmospheric air at a velocity that ensures that atmospheric precipitation not frozen fast onto the surface element(s) is substantially thrown off the surface element(s).

7. (Amended) A method according to [any one of the preceding claims] claim 1, wherein at least two surface elements are used that are rotatably arranged on a rotor shaft; and that the movement of the two surface elements is accomplished by a rotation of the rotor shaft.

10. (Amended) An apparatus according to claim [8 or] 9, comprising means for heating the surface element(s).

11. (Amended) An apparatus according to [any one of claims 8 through] claim 10, wherein the apparatus comprises a rotor element with a rotor shaft (2), and at least two surface elements (3) that extend from the rotor shaft and protrude there from, and wherein means (4) are provided for rotating the rotor about its axis.

12. (Amended) An apparatus according to [any one of claims 8 through] claim 11, wherein the apparatus comprises a cover (6) whose inside faces towards the surface elements and which is configured for occupying a first position in which it extends across the surface

element(s) that is/are hereby covered upwardly, and a second position in which the cover is removed and does not cover the surface element(s).

15. (Amended) An apparatus according to [any one of claims 12 through] claim 14, wherein the apparatus is configured for moving the surface element(s) for a predetermined period of time after the cover (6) has, following a measurement procedure, reverted to its first position, whereupon the thickness or mass of ice frozen fast can be determined.

16. (Amended) An apparatus according to [any one of claims 12 through] claim 15, wherein the cover is, in its second position, positioned such that its inside is substantially protected against atmospheric precipitation and consequently remains dry.

17. (Amended) An apparatus according to [any one of claims 8 through] claim 16, wherein the surface element(s) each consists of a plate having a front (13) and a back (14) oriented opposite thereto, and wherein the plate is configured in such a manner that the front of the plate faces in the direction in which the respective surface element is moved through the atmospheric air, and wherein - through the plate - a plurality of passageways (1) extend from the front of the plate to its back such that the atmospheric air is allowed to flow through the passageways from the front of the plate to the back of the plate.

18. An apparatus according to [any one of claims 8 through] claim 17, wherein the apparatus comprises a system of surface elements (21, 22, 23, 24) mounted on a rotatable shaft (2) configured for being

positioned in an essentially vertical position; and wherein the individual surface elements are configured and arranged such that the individual surface elements, corresponding to their projection on a face perpendicular to the rotatable shaft, abuts on or overlaps other surface elements, whereby it is accomplished that there is no space between the individual surface elements when the apparatus is viewed from above, and thus that all atmospheric precipitation falling within the expanse of the apparatus, when the rotatable shaft is positioned vertically, essentially hits the surface elements and is thus able to settle in the form of ice.

20. (Amended) An apparatus according to [any one of claims 8 through] claim 19, wherein the surface elements are configured with passageways; and that the apparatus comprises means such that air can be conveyed through the passageways.

22. (Amended) An apparatus according to [any one of claims 8 through] claim 21, wherein the apparatus is arranged at ground level in an airport; and that the apparatus comprises means for recording the measurement results for the thickness or mass of the ice deposited on the surface element(s), and means for visually or auditively a signal to the monitoring personnel about the measurement result.

A method and an apparatus for measuring icing

The present invention relates to a method and an apparatus for local measurement of an icing factor for atmospheric air containing supercooled water.

Such measurement are used in particular - but not exclusively - within the fields of aviation and navigation, wherein icing can constitute a substantial safety hazard when it comes to wrecking.

The problem arises as a result of atmospheric precipitation, such as rain and mist, that has in its supercooled state a known propensity to freeze on to objects, such as hull and machine parts on vessels as well as aeroplanes.

Thus, in practise critical weather conditions have often necessitated manual observations with a view to forming an impression of the acute risk of icing, in order to enable warning of aeroplanes and vessels, if necessary.

It is a problem in this context that such manual observation is based on a subjective discretion, and that consequently a standardised value for the risk of icing is not accomplished. Thus, a warning based on such subjective discretion will be associated with a good deal of insecurity, and the person who receives the warning cannot readily form a reliable picture of the risk of icing, except by relying on the recommendation of the issued warning.

Accordingly, US patent No 4,730,485 and published NO patent application No 151,060 teach apparatuses configured

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ART 134 AND 1

for carrying out a more standardised measurement of the amount of atmospheric precipitation.

Thus, US patent No 4,730,485 teaches a stationary measurement device configured for measuring wind velocity as well as wind direction, but it is also suitable for measurement of the current icing.

Published NO patent application No 151,060 discloses a stationary weighing apparatus for weighing an amount of atmospheric precipitation in the form of snow or ice that settles on a substantially horizontal weighing plate.

However, it is a problem in connection with these prior art devices that icing often occurs in situations when the air is relatively still, and that the icing factor measured by such devices are erroneous since only small amounts of ice are deposited on the devices.

It is a further problem in connection with the prior art device known from published NO patent application No 151,060 that atmospheric precipitation other than super-cooled water may deposit on the weighing plate and thus an erroneous weighing results in relation to the icing factor.

US patent 3 940 622 discloses a detector for detecting the rate of ice-formation. In order to provide an in-stream of air, ambient air flow is created by inducing a primary gas into a duct, the primary gas being supplied, for example, by the engine compressor of a VTOL aircraft.

US patent 5 317 915 is concerned with the problem of detecting icing-up of a rotor of an aircraft. This known measuring device comprises means for determining an axial

ART 134 ANNUL

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load on the rotor axis under dynamic circumstances, i.e. during operation of the rotor.

It is therefore the object of the present invention to provide a method and an apparatus whereby it is possible, in almost all weather conditions, in particular also light winds and still air, to provide a standardised measurement result or a standardised value for the icing factor.

This is achieved with the present invention by the method according to claim 1, or by use of an apparatus according to claim 8.

The method according to the present invention thus comprises the following process steps, wherein at least one surface element is provided that is made of a material suitable for ice in atmospheric air to freeze on, said element having a predetermined surface area, wherein the surface element(s) is/are brought to a temperature that corresponds essentially to the temperature of the atmospheric air, wherein a relative movement at a predetermined velocity is subsequently created between the atmospheric air and the surface element(s) by allowing the surface element(s) to move through the atmospheric air, and for a predetermined period of time, and wherein the thickness or mass of the ice frozen fast to the surface element(s) is subsequently measured by means of a measurement device configured therefore after said predetermined period of time.

This means, on the one hand, that atmospheric precipitation other than supercooled raindrops or mist can only with difficulty settle on the surface elements and adversely influence the measurement results, and that it is

ART 34 ADULT

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hereby possible to perform relatively accurate measurements of the icing factor, also in relatively still air.

5 In case the factor measured is the thickness of the ice layer, it is advantageous - to obtain a representative value therefore - to measure in a number of points, preferably in one or more points on each surface element, the measurement results subsequently being summarised to a single value.

10

The value thus measured for the thickness of ice layer or weight increase will be a standardised factor that indicates a relative risk of icing of eg aeroplanes or vessels in the area in which measurement is performed. It goes without saying that the value can only be indicative of the risk since, obviously, it will vary more or less compared to the place where the measurement was performed.

15

20 The method can advantageously be exercised by use of an apparatus as featured in claim 8, said apparatus comprising at least one surface element (3) made of a material suitable for ice in atmospheric air to freeze on, wherein the surface element(s) has/have a predetermined surface area, and wherein the apparatus further comprises means (4) configured for moving the surface element(s) through the atmospheric air at a predetermined rate and for a predetermined period of time, and wherein further means (5) are provided for measuring the thickness or mass of the ice frozen fast onto the surface element(s) after the predetermined period of time, during which the surface element(s) has/have been moved through the atmospheric air.

25

30

35 According to a preferred embodiment of the method, it is ensured that frozen-on ice, if any, is removed prior to a

ART 34 ANNUL

9a

first measurement, and likewise the frozen-on ice is removed from the individual surface element following measurement of its mass or thickness, whereupon a renewed measurement process can be performed. Advantageously,

5 such removal of the ice can be accomplished by heating of

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the individual surface elements either from the outside or from the inside.

Further advantageously, uniform measurement results are accomplished if a cover is provided that extends at least across the surface element, and covers and shields the surface element, and said cover being removed from the surface element at least for the predetermined period of time during which the surface element is moved through the atmospheric air at a predetermined velocity.

The accuracy of measurement is further enhanced if the surface element is moved through the atmospheric air at a velocity that ensures that atmospheric precipitation that does not freeze on to the surface element is to a substantial extent thrown off the surface element.

In order to ensure that the inside of the cover is protected against atmospheric precipitation settling thereon, it can advantageously be so arranged in its second position that its inside is protected against atmospheric precipitation. It is hereby ensured that atmospheric precipitation cannot drip from the inside of the cover and onto the surface elements when the cover is conveyed across same.

In order to ensure that the surface elements are essentially free of other atmospheric precipitation prior to the amount thereof being determined, they can advantageously be rotated for a predetermined period of time following return of the cover to its first position.

According to a particularly simple method, at least two surface elements are used that are rotatably arranged on

a rotor shaft whereby the movement of the two surface elements is effected by a rotation thereof about the rotor shaft.

- 5 According to a particularly simple embodiment, the apparatus comprises a weighing device configured for weighing and recording at least the weight of the surface element prior to and after movement of the surface element through the atmospheric air.

10

According to a particularly simple embodiment the apparatus comprises a rotor with a rotor shaft, and at least two surface elements that extend from the rotor shaft and protrude there from, and wherein means are configured for
15 rotating the rotor about its axis. Hereby it is obtained that the movement mechanisms that bring about the movement of the surface elements through the air can be accomplished in a very simple manner that does not require maintenance.

20

Besides, with a view to also obtaining an increased accuracy of measurement the apparatus can also comprise a cover that is configured for assuming a first position in which it extends across the surface element, and thereby
25 covers this upwardly, and a second position in which the cover has been removed from the surface element and does not cover same, and this cover is preferably configured such that in its first position, it forms a closed space around the surface element.

30

In order to be able to perform measurements in quick succession, means are conveniently provided that are, on the one hand, able to heat the surface elements in order to melt the ice deposited thereon, and on the other, to cool

them to approximately ambient temperature. This can be obtained in that the surface elements are configured with passageways; and that the apparatus comprises means whereby air can be conveyed through the passageways either in the form of heated air or air with approximately ambient temperature. Heating and cooling of the surface elements can also be accomplished by the closed space underneath the cover being heated and cooled.

10 It is desirable that the ice formation on the surface elements is as comprehensive as possible to ensure accuracy and speed of measurement, and consequently the surface element will, in a first preferred embodiment, be in the form of a plate with a front and a back which have
15 opposite orientations relative thereto; and wherein the plate is configured in such a manner that the front of the plate faces in the direction in which the surface element is moved through the atmospheric air; and wherein - through said plate - a plurality of passageways are
20 provided from the front of the plate to the rear of the plate, whereby atmospheric air is able to flow through the passageways from the front of the plate to the back of the plate.

25 According to an alternative, preferred embodiment the apparatus comprises a system of surface elements mounted on a rotatable shaft configured for being arranged in a substantially vertical position. The individual surface elements are configured and arranged such that the individual surface elements will, in correspondence with their
30 projection on a face perpendicular to the rotatable axis, abut on or overlap other surface elements, which means that there is no space between the individual surface elements when the apparatus is viewed from above. Hereby

it is obtained that all atmospheric precipitation within the expanse of the apparatus hits the surface elements and thus can be deposited in the form of ice. The larger the overlap between the individual surface elements, the larger the deviation from vertically falling precipitation can be tolerated while ensuring this.

In correspondence with the above teachings, the surface elements can advantageously be configured and arranged such that the individual surface elements corresponding to their projection on a face parallel with the rotatable axis abuts on or overlaps other surface elements, so as to accomplish that there is no space between the individual surface elements when the apparatus is viewed from the side. Hereby it is obtained that the atmospheric air conveyed across the surface elements by the relative movement between the atmospheric air and the surface elements hits a surface element and is thereby able to deposit the water contained therein in the form of ice.

In case of embodiments like the ones described above, it is ensured that the apparatus can be configured with the smallest possible physical dimensions.

The apparatus according to the present invention is particularly suitable for use in airports, where the apparatus is preferably arranged at ground level in an airport, and whereby the apparatus comprises means for recording the measured results of the thickness or mass of the ice deposited on the surface elements, and means for visually or auditively emitting a signal regarding the measurement results to the monitoring personnel of the airport.

The invention will now be described in further detail with reference to the drawings, wherein

5 Figures 1 through 4 are explanatory sketches using a schematically represented apparatus to illustrate various process steps according to the present invention;

10 Figure 5 is a sectional view that illustrates a vertical, sectional view through a surface element for use in the apparatus according to the present invention;

15 Figures 6 through 8 show a first, preferred embodiment of an apparatus according to the invention, wherein the cover is shown in different positions;

Figure 9 shows an alternative, preferred embodiment of an apparatus according to the invention, seen from the side;

20 Figure 10 is a vertical, sectional view through the apparatus shown in Figure 9 corresponding to the plane indicated by B-B;

25 Figure 11 illustrates a preferred embodiment of a rotor element for use in connection with the invention;

Figure 12 is a top plan view of the rotor element corresponding Figure 11; and

30 Figure 13 shows a further preferred embodiment of a rotor element for use in connection with the invention.

Thus, Figure 1 shows the constructive principles of an apparatus according to the invention, said apparatus comprising a housing or a frame 1, in which a shaft or a ro-

tor 2 is arranged that supports two diametrically opposed surface elements 3, and that are rotated by a drive unit 4 in the direction of the arrow A. The rotor with one or more surface elements is also referred to as the rotor element.

Corresponding the normal operative state of the apparatus, the shaft or the rotor is configured for being arranged in a substantially vertical position. When, in the following, the terms vertical and horizontal are used, they refer to the apparatus when arranged in such preferred position.

Additionally the apparatus comprises a weighing device 5 configured for weighing the surface elements 3, the rotor 2 and the drive unit 4, whereby a weight increase can be determined.

Besides, the apparatus comprises a movable cover, in Figures 1 through 4 shown as a dome-shaped shield consisting of two spherical quarter shells 6 that are shown in Figure 1 in a first position in which they shield the surface elements 3 and the rotor 2 and form a substantially closed space 7 around the surface elements and the rotor.

Moreover, the apparatus comprises a blower 8 configured for conveying atmospheric air towards the surface elements 3.

In the process step shown in Figure 1, the rotor is thus rotated in the closed space 7, and as a consequence of the blower 8 generating circulation of air in that space, the surface elements 3 are caused to assume a temperature that corresponds essentially to the ambient temperature.

Now, Figure 2 illustrates a subsequent process step in which the two spherical quarter shells 6 have been withdrawn to a second position in which the surface elements 3 on the rotor 2 rotate in the open air, and wherein - provided supercooled water is present in the air - ice formations will settle on the surface elements 3. It will appear from the figure that the cover in its second position is situated within the housing that is advantageously configured such that inside of the cover is protected against atmospheric precipitation settling thereon. In the embodiment shown, this could only be accomplished by the spherical shells of the cover being conveyed down into the housing through a narrow opening between the top face and lateral walls of the housing. Such configuration ensures that atmospheric precipitation cannot drip from the inside of the cover and down onto the surface elements when the cover is conveyed above them.

In accordance with the invention, the process step shown in Figure 2 is carried out for a predefined period of time, whereby a suitable amount of ice will deposit on the surface elements, and the rotor is rotated at a velocity that, on the one hand, takes into account that the ice is not to be thrown off the rotor, but wherein other precipitation, if any, in the form of rain and snow is thrown off to a suitable extent. As shown in the figure, it is of course to be ensured that the cover can be conveyed past the various structures of the housing.

Advantageously, the weighing device can be configured with three weighing cells situated triangularly between the drive unit 4 and the lower part of the housing.

Hereby a stable determination of weight for the drive unit, the rotor, the surface elements and the ice frozen thereon is obtained.

- 5 Following the process step shown in Figure 2, a subsequent step is shown in Figure 3 wherein the cover has been returned to its first position. In order to ensure that the surface elements are substantially free of atmospheric precipitation other than ice before the amount
10 thereof is determined, they can advantageously be rotated for a predetermined period of time after the cover has reverted to its first position.

- Now the surface elements are brought to a halt, and the
15 weight increase of the surface elements resulting from the ice deposited on its surfaces is recorded by means of the weighing device 5, and on the basis of the value measured, a signal can be generated for showing an icing factor; however, the drawing does not feature equipment
20 for this use since it will be obvious to the person skilled in the art to configure such equipment on the basis of the present description.

- Now a subsequent process step is shown in Figure 4
25 wherein the two spherical quarter shells 6 have been moved across the surface elements 3 and shield them so as to form yet again the closed space 7. In this process step the rotor is caused to rotate, and a quick heating of the closed space 7 is carried out by means of the
30 blower 8 and a heater element 9 whereby the ice deposited on the surface elements is melted and thrown off by the rotation of the rotor, whereby the combined weight of the rotor 2 and the surface elements 3 is caused to revert to the initial weight.

Now the process step shown in Figure 1 can proceed, and the apparatus according to the invention is thus very suitable for carrying out repeated measurements with a
5 very high degree of accuracy in standardised conditions.

In order to obtain the highest possible accuracy of measurement, the surface elements 3 should be configured with the largest possible surface for adhesion of ice. Figure
10 5 illustrates an embodiment wherein a surface element is constructed as a grid, as seen in a vertically sectional view through this, and from which it will appear that the surface element that is moved in the direction of the arrow B has a front 13 and a back 14; and wherein walls
15 11,12 combine to form passageways 10 that extend from the front 13 to the back 14.

Hereby the surface element forms a relatively large surface compared to the indigenous weight of the surface
20 element which means that a relatively quick formation of a suitable and measurable amount of ice is accomplished on the surfaces of the surface element 3, and such that the surface element can quickly be caused to assume the desired temperatures by the heating as shown in Figure 4
25 and the cooling as shown in Figure 1.

Both walls 11,12 having a downwardly tapering course means that, on the one hand, atmospheric precipitation other than supercooled water or mist is very like to
30 slide or flow off the surface element 3, but also that supercooled water droplets or mist are very like to settle on the surfaces of the surface element without having to pass all the way through the surface element.

The surface elements shown in Figures 1 through 4 are, for the sake of clarity, shown to be very small, but according to a preferred embodiment they are dimensioned to essentially fill the space 7, which means that the surface elements as shown in Figures 1 through 4 join to constitute an approximate semicircle. Hereby it is ensured that the apparatus can be configured with the smallest possible outer dimensions.

As described above, it should be ensured that the inside of the cover is protected against atmospheric precipitation in all process steps; and this is to ensure accurate determination of the amount of ice frozen fast there on.

Figures 6 through 8 show an embodiment in which an apparatus comprises a housing 1, a cover in the form of two spherical quarter shells 6, two storage units 41 for the two spherical quarter shells and a platform 40 on which the storage units have been arranged. Furthermore the apparatus comprises a rotor element, a drive unit and a (not shown) weighing device as described above.

In a first position the cover 6A covers the rotor element and forms a substantially closed space; in Figure 6 this is outlined with dotted lines. When it is desired to perform a measurement, the elements of the cover are, as shown in Figures 6, 7 and 8, moved to their second position where they are stored for protection in the storage units 41. Since it is in particular the inside of the cover that is to be protected against atmospheric precipitation, it can be chosen to allow the storage units to be upwardly open, which would simplify the construction. Once the first part of the measurement is accomplished the cover reverts to its first position.

Above it has be outlined schematically how protection of the cover inside against the weather can be accomplished, but of course it is possible to select the configuration, shape and the mutual relations of the cover and the storage units on the basis of many considerations.

Figure 9 shows a further embodiment wherein the apparatus comprises a housing 101 with a drive unit, a frame 110, a control unit 115, a cover 106, and a rotor element 103. The housing 101 is configured as a closed and approximately semicylindrical object cut-off in correspondence with the cylinder axis; the housing is mounted in a frame 110 such that the cylinder axis is substantially embedded horizontally. The cover 106 is also configured as approximately as a semicylinder cut-off in correspondence with its cylinder axis and open in correspondence with the cut edge. The cover is mounted on the frame 110 in such a manner that the cylinder axis of the cover essentially coincides with the cylinder axis of the housing. The cover is configured with a width that is wider (corresponding to the length of the cylinder axis) and a cylinder radius that is larger than the housing, and pivotally mounted on the frame such that the cylinder axis of the cover also constitutes its axis of rotation. This configuration of the cover and housing makes it possible for the cover, upon a 180 degree rotation about its axis of rotation, to be conveyed from its first position as shown in Figure 9 to a second position underneath the housing, and such that the housing is essentially enclosed in the cover. In Figure 9, the end face of the cover towards the viewer has been removed such that the rotor element 103 arranged on top of the housing is visible. When the cover is turned away as described above,

the rotor element will be uncovered and a measurement can be initiated. As also described above, this device will ensure that the inside of the cover is protected against atmospheric precipitation while in its second position.

5

Study of Figure 10 will now reveal a section through the apparatus shown in Figure 9 corresponding to the plane indicated by B-B. As will appear, the housing is - by means of two fittings 112,113 - mounted in a frame consisting of two posts 110,111. As described above, the housing as well as the cover are mounted with their respective cylinder axes about a common axis 102. The rotor element 103 comprises a rotor shaft 120 and a system of surface elements of which only the top 121 and bottom ones are shown. The overall cylindrical shape of the rotor element is outlined with dotted lines. In the space 107 between the cover and the housing, a sealing is advantageously arranged whereby it is prevented both that atmospheric precipitation penetrates into the space between the cover and the housing and that the atmospheric precipitation that has found its way to the space, if any, will be removed from the inside of the cover when it is conveyed from its second to its first position. As shown in Figures 9 and 10, the top face of the housing is configured as an upwardly conical face, whereby it is ensured that eg melt water is, upon heating of the surface elements, conveyed away from the housing and in particular away from the rotor shaft passage.

30 Between the posts a control unit 115 is arranged for controlling the drive unit 104, the weighing unit 105, the blower 108, and the heater element 109, and for collection, storage and optionally transmission of measurement data. Such units are configured for functioning in a man-

ner similar to the one described above with reference to Figures 1 through 4. In Figure 10 it is indicated that air is, by means of the blower 8, blown into the rotor shaft and from there conveyed out through the surface elements as also described above. Between the top part of the housing and the rotor shaft, a (not shown) bearing device can advantageously be arranged for supporting and guiding the shaft. According to a preferred embodiment, the apparatus further comprises (not shown) means for automatically shifting the cover between its first and second positions. Obviously, the apparatus comprises a device for securing the cover in its first position; preferably also in its second position.

A preferred embodiment of a rotor element for use in an apparatus according to the invention will now be described with reference to Figures 11, 12 and 13.

In Figure 11, the rotor element comprises a shaft 20 on which four stacks are arranged that each consists of a number of surface elements arranged at a mutual distance opposite each other with the respective top surface elements 21,22,23,24 arranged in an uppermost plane. Each surface element has a free outer end and an inner end secured to the shaft. The uppermost face elements are arranged with a constant mutual angular distance that corresponds to an angle of 90 degrees as far as four top surface elements are concerned.

As will appear from the figure, the surface elements in the individual stack are displaced relative to each other with the outer free ends arranged so as to generally form a helix. For each stack this helix extends at least over an angle corresponding to the angle between two succes-

sively arranged stacks. For an embodiment with four stacks a helix thus extends over at least 90 degrees. In a particular case where only one stack is used, such stack will be able to extend a full rotation about the shaft, ie 360 degrees.

The individual surface elements are configured and arranged such that, in correspondence with their projection on a horizontal face, they overlap the surface element(s) that are adjacent to or arranged between, respectively, the individual surface elements, so as to eliminate spaces between the individual surface elements when the apparatus is viewed from above. This is shown in Figure 12 that illustrates the apparatus according to Figure 11, seen from above. Hereby it is obtained that atmospheric precipitation falling within the expanse of the apparatus hits the surface elements and is thus able to settle in the form of ice. The larger the overlap between the individual surface elements, the larger a deviation from vertically falling atmospheric precipitation can be tolerated, while ensuring this.

In correspondence with the above teachings, the surface elements in the embodiment shown can advantageously be configured and arranged such that the individual surface elements corresponding to their projection on a vertical face abut on or overlap the surface elements (5) that adjoin or surround, respectively, the individual surface element so as to eliminate a space, if any, between the individual surface elements when the apparatus is seen from the side. Hereby it is obtained that the atmospheric air conveyed across the surface elements by the relative movement between the atmospheric air and the surface elements hits a surface element and is thereby able to de-

posit the water contained therein as ice. This is in accordance with the disclosures above with reference to Figure 5.

- 5 In an embodiment as shown in Figures 11 and 12 it is further ensured that the apparatus can be configured with the smallest possible outer dimensions. For instance, an embodiment with four stacks of each eleven surface elements and a diameter of 70 cm has proven to be convenient.
- 10

As will also appear from Figure 11, the individual surface elements are provided with a number of passageways 25 through which air can be blown, heated air to deice the surface elements and air with ambient temperature for tempering the surface elements prior to the next measurement, respectively. According to a convenient embodiment the air is conveyed from the basis of the apparatus to the surface elements through the shaft 20.

15

20

- In accordance with the embodiment shown in Figure 11, the surface elements are attached only to the shaft 20 in correspondence with their one end, and this is why the individual surface element is dimensioned to support itself and resist the forces that will occur during the intended use of the apparatus. In an alternative embodiment shown in Figure 13, a large number of rather thin surface elements are used that will be secured partly in correspondence with their inner end to the shaft, partly secured with their outer end to a support structure. This support structure comprises an upper support element 30 secured to the shaft by means of upper connecting means 31 and a lower support member 32 secured to the shaft by means of lower connecting elements 33. Between the upper
- 25
- 30

and the lower support elements a number of outer support elements 34 are arranged, to which the outer end of the surface elements are secured. Corresponding to the above-described embodiment, four stacks of surface elements are also used herein that are in a corresponding manner supported by four outer support elements 34.

Corresponding to the embodiment shown in Figure 11, the surface elements have equal lengths, which means that each helix extends in a manner that corresponds to the surface of a cylinder and, likewise, the overall shape of the rotor element will be cylindrical. In the alternative embodiment shown in Figure 13, for each stack surface elements are used that have decreasing length towards the top of the apparatus; if the length decreases linearly the individual outer support element 34 will have a course corresponding to a helix on the surface of a cone, and - likewise - the overall shape of the rotor element will in that case be a cone. As stated above, the overall shape and dimensions of the rotor element and the cover will conveniently correspond to each other. For an embodiment of the apparatus like the one shown in Figures 6 through 8, the rotor element should thus be semispherical.

Of course, it is possible in case of both the described embodiments to arrange surface elements such that the helix-shape described is not a 'perfect' geometrical helix but merely what the person skilled in the art describes as "spiral-shaped".

Obviously, on the basis of the above explanation of the principle underlying the invention, the person skilled in the art will readily be able to point to various embodi-

ments of the construction of an apparatus that is able to perform said process steps as well as to identify process parameters that are suitable therefor with due regard to the configuration of the apparatus, such as the period of time during which the surface elements are to be moved through the open air as shown in Figure 2, and the rate at which the surface elements 3 are to be moved through the air in order to obtain suitable measurement results that are not considerably influenced in case atmospheric precipitation other than supercooled water and mist is deposited on the surface elements 3. Obviously, there is a correlation between the configuration of the apparatus itself and the operation parameters that ensure that the desired measurement results are obtained.

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ART 34 AND 1

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C l a i m s

1. A method for local measurement of an icing factor for
atmospheric air containing supercooled water, the method
5 comprising the following process steps:

wherein at least one surface element (3) is provided that
is made of a material suitable for ice in atmospheric air
to freeze on, said element having a predetermined surface
10 area;

wherein the surface element(s) is/are brought to a
temperature that corresponds essentially to the
temperature of the atmospheric air;

wherein a relative movement at a predetermined velocity
is subsequently created between the atmospheric air and
the surface element(s) by allowing the surface element(s)
to move through the atmospheric air, and for a predeter-
20 mined period of time;

and wherein the thickness or mass of the ice frozen fast
to the surface element(s) is subsequently measured by
means of a measurement device configured therefore after
25 said predetermined period of time.

2. A method according to claim 1, wherein the ice frozen
fast is, following measurement its mass or thickness, re-
moved from the surface element(s), whereupon a renewed
30 measurement process can be performed.

3. A method according to claim 2, wherein the ice frozen
fast is removed by heating of the surface element(s).

4. A method according to any one of the preceding claims,
wherein a cover is provided that in a first position ex-

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tends at least across the surface element(s), and covers and shields the surface element(s); and said cover being removed from the surface element(s) at least for the predetermined period of time during which the surface element(s) is/are moved through the atmospheric air at a predetermined rate.

5. A method according to claim 4, wherein the surface element(s) is/are caused to move for a predetermined period of time after the cover has reverted to its first position following a measurement procedure, whereupon the thickness or mass of the ice frozen fast on the surface element(s) is measured.

6. A method according to any one of the preceding claims, wherein the surface element(s) are caused to move through the atmospheric air at a velocity that ensures that atmospheric precipitation not frozen fast onto the surface element(s) is substantially thrown off the surface element(s).

7. A method according to any one of the preceding claims, wherein at least two surface elements are used that are rotatably arranged on a rotor shaft; and that the movement of the two surface elements is accomplished by a rotation of the rotor shaft.

8. An apparatus for local measurement of an icing factor for atmospheric air containing supercooled water, wherein the apparatus comprises at least a surface element (3) made of a material suitable for ice in atmospheric air to freeze on, wherein the surface element(s) has/have a predetermined surface area, and wherein the apparatus further comprises means (4) configured for moving the surface element(s) through the atmospheric air at a predetermined rate and for a predetermined period of time, and

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wherein further means (5) are provided for measuring the thickness or mass of the ice frozen fast onto the surface element(s) after the predetermined period of time, during which the surface element(s) has/have been moved through the atmospheric air.

9. An apparatus according to claim 8, comprising a weighing device (5) configured for weighing and recording at least the weight of the surface element(s) before and after the surface element(s) is/are caused to move through the atmospheric air.

10. An apparatus according to claim 8 or 9, comprising means for heating the surface element(s).

11. An apparatus according to any one of claims 8 through 10, wherein the apparatus comprises a rotor element with a rotor shaft (2), and at least two surface elements (3) that extend from the rotor shaft and protrude there from, and wherein means (4) are provided for rotating the rotor about its axis.

12. An apparatus according to any one of claims 8 through 11, wherein the apparatus comprises a cover (6) whose inside faces towards the surface elements and which is configured for occupying a first position in which it extends across the surface element(s) that is/are hereby covered upwardly, and a second position in which the cover is removed and does not cover the surface element(s).

13. An apparatus according to claim 12, wherein the cover is configured such that it forms, in its first position, a closed space (7) around the surface element(s).

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8 25

14. An apparatus according to claim 13, wherein means (8,9) are provided for heating the closed space underneath the cover.

5 15. An apparatus according to any one of claims 12 through 14, wherein the apparatus is configured for moving the surface element(s) for a predetermined period of time after the cover (6) has, following a measurement procedure, reverted to its first position, whereupon the
10 thickness or mass of ice frozen fast can be determined.

15 16. An apparatus according to any one of claims 12 through 15, wherein the cover is, in its second position, positioned such that its inside is substantially protected against atmospheric precipitation and consequently remains dry.

20 17. An apparatus according to any one of claims 8 through 16, wherein the surface element(s) each consists of a plate having a front (13) and a back (14) oriented opposite thereto, and wherein the plate is configured in such a manner that the front of the plate faces in the direction in which the respective surface element is moved through the atmospheric air, and wherein - through the
25 plate - a plurality of passageways (10) extend from the front of the plate to its back such that the atmospheric air is allowed to flow through the passageways from the front of the plate to the back of the plate.

30 18. An apparatus according to any one of claims 8 through 17, wherein the apparatus comprises a system of surface elements (21,22,23,24) mounted on a rotatable shaft (20) configured for being positioned in an essentially vertical position; and wherein the individual surface elements
35 are configured and arranged such that the individual surface elements, corresponding to their projection on a

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face perpendicular to the rotatable shaft, abuts on or overlaps other surface elements, whereby it is accomplished that there is no space between the individual surface elements when the apparatus is viewed from above, and thus that all atmospheric precipitation falling within the expanse of the apparatus, when the rotatable shaft is positioned vertically, essentially hits the surface elements and is thus able to settle in the form of ice.

19. An apparatus according to claim 18, wherein the surface elements are configured and arranged such that the individual surface elements corresponding to their projection on a face parallel with the rotatable shaft (20) abuts on or overlaps other surface elements, whereby there is no space between the individual surface elements, when the apparatus is viewed from the side, and such that the atmospheric air conveyed across the surface elements in a direction substantially perpendicular to the shaft by a relative movement between the atmospheric air and the surface elements substantially hits a surface element and is thus able to deposit the water contained therein as ice.

20. An apparatus according to any one of claims 8 through 19, wherein the surface elements are configured with passageways; and that the apparatus comprises means such that air can be conveyed through the passageways.

21. An apparatus according to claim 20, wherein the apparatus comprises means for providing air in the form of either heated air or air essentially with ambient temperature.

22. An apparatus according to any one of claims 8 through 21, wherein the apparatus is arranged at ground level in

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an airport; and that the apparatus comprises means for recording the measurement results for the thickness or mass of the ice deposited on the surface element(s), and means for visually or auditively emitting a signal to the
5 monitoring personnel about the measurement result.

23. An apparatus according to claim 22, wherein the apparatus comprises means for converting the thickness or mass measured into a value that will be indicative of a
10 risk of icing.

PCT/2001/00094

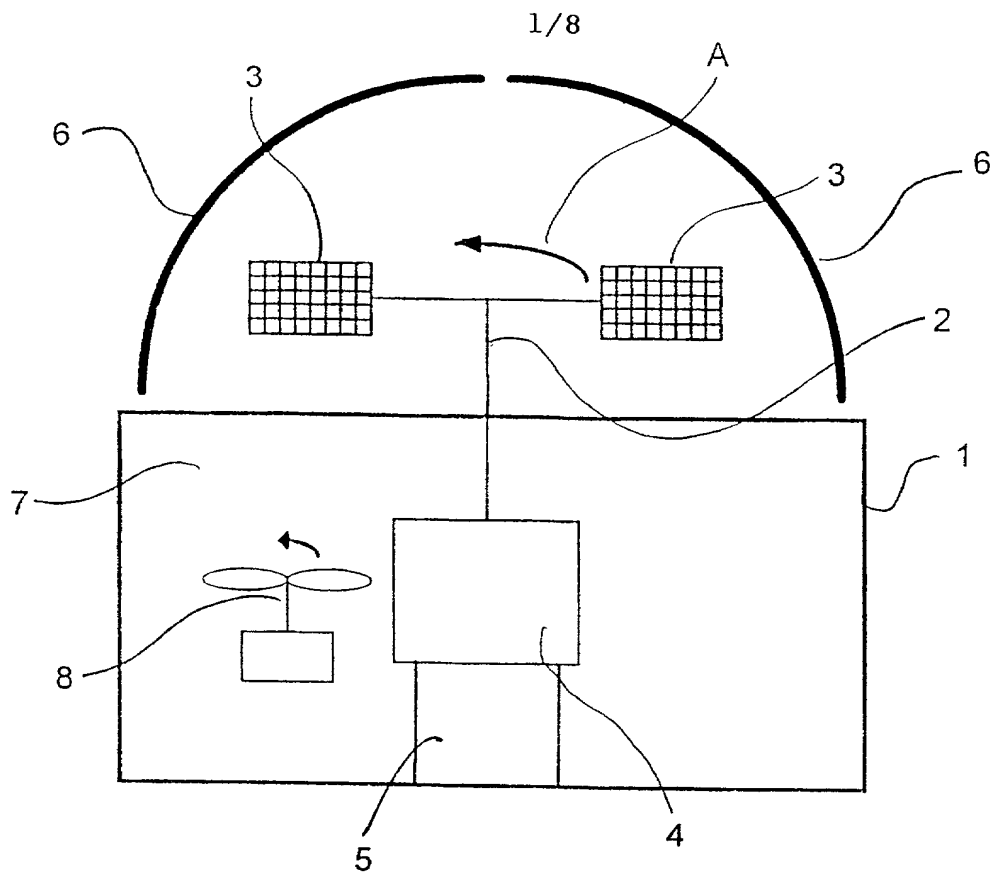


Fig. 1

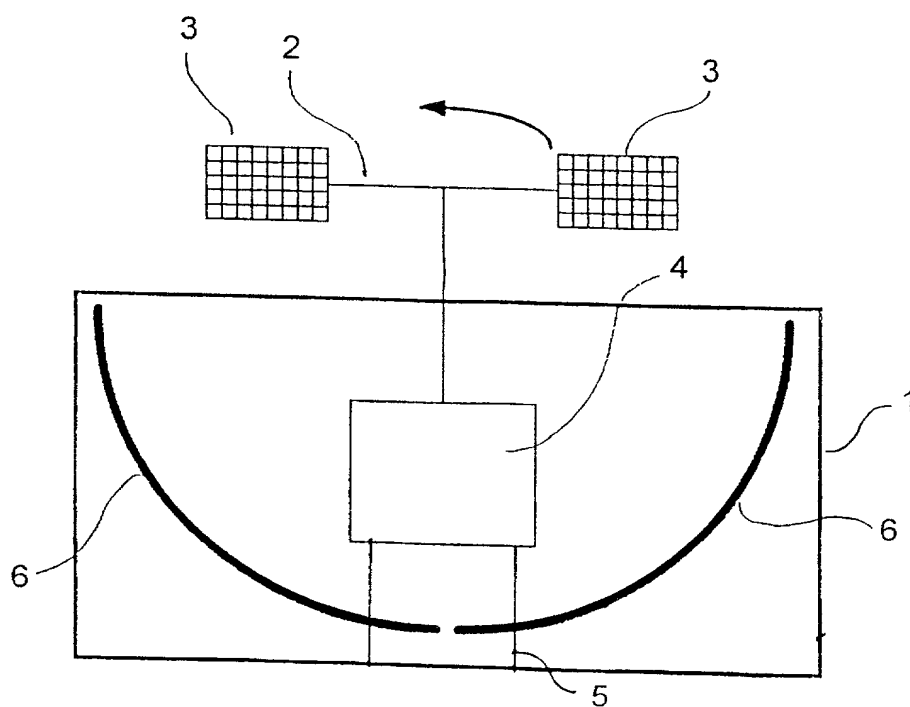


Fig. 2

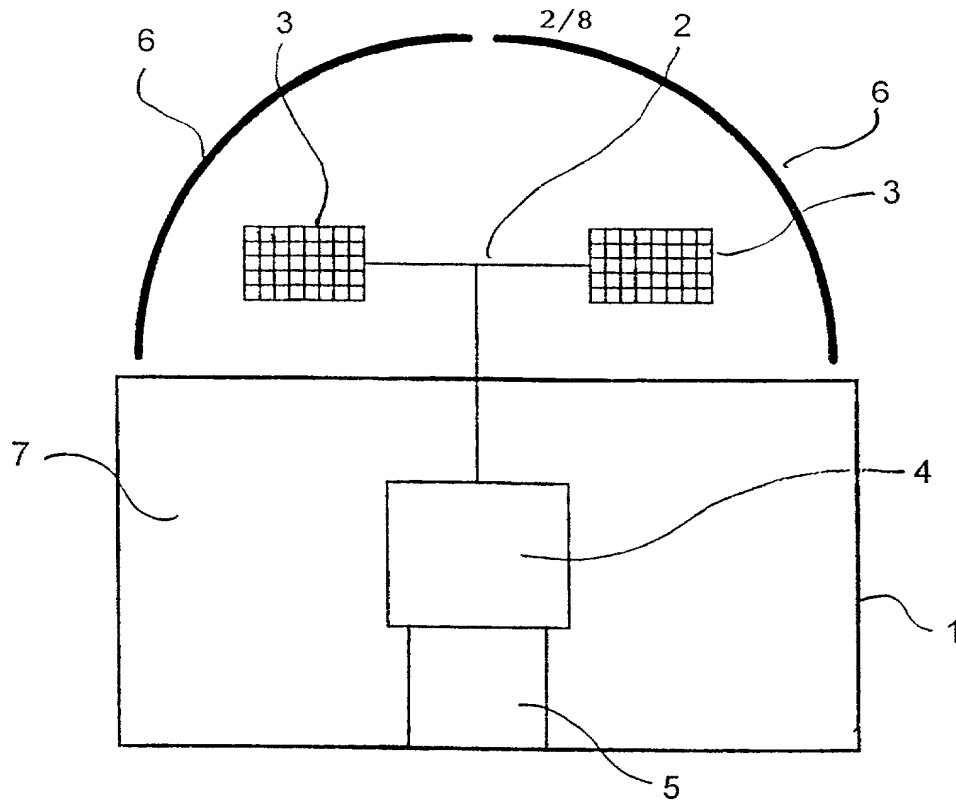


Fig. 3

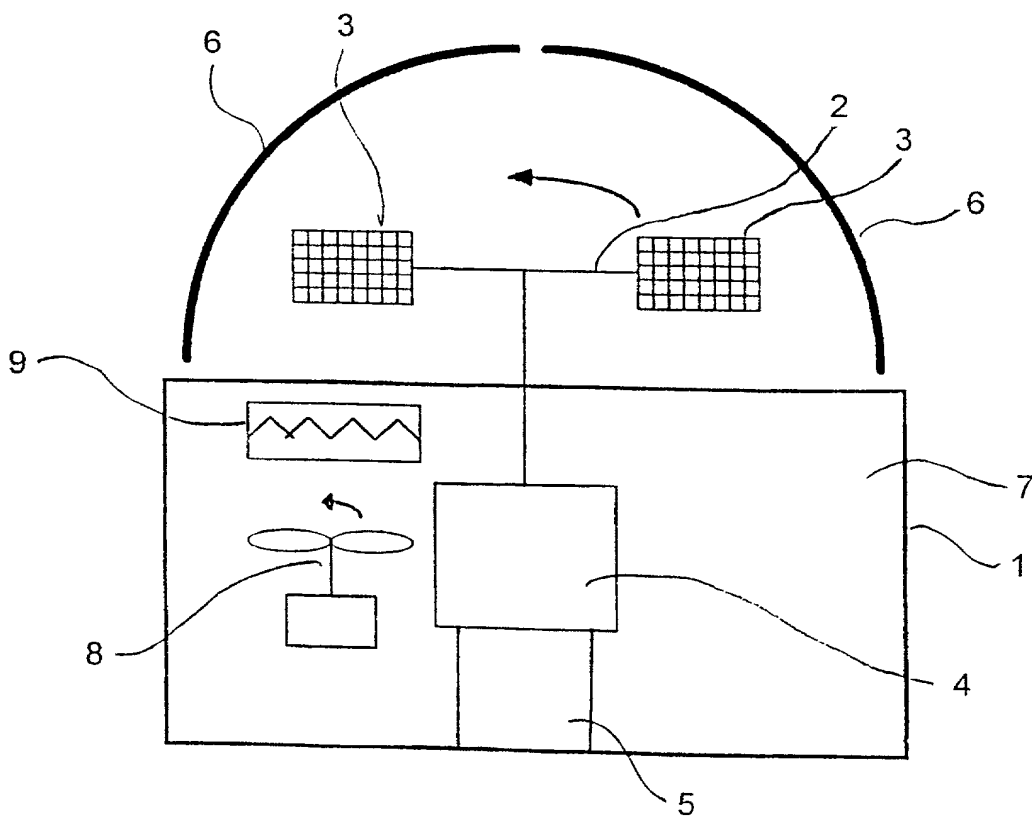


Fig. 4

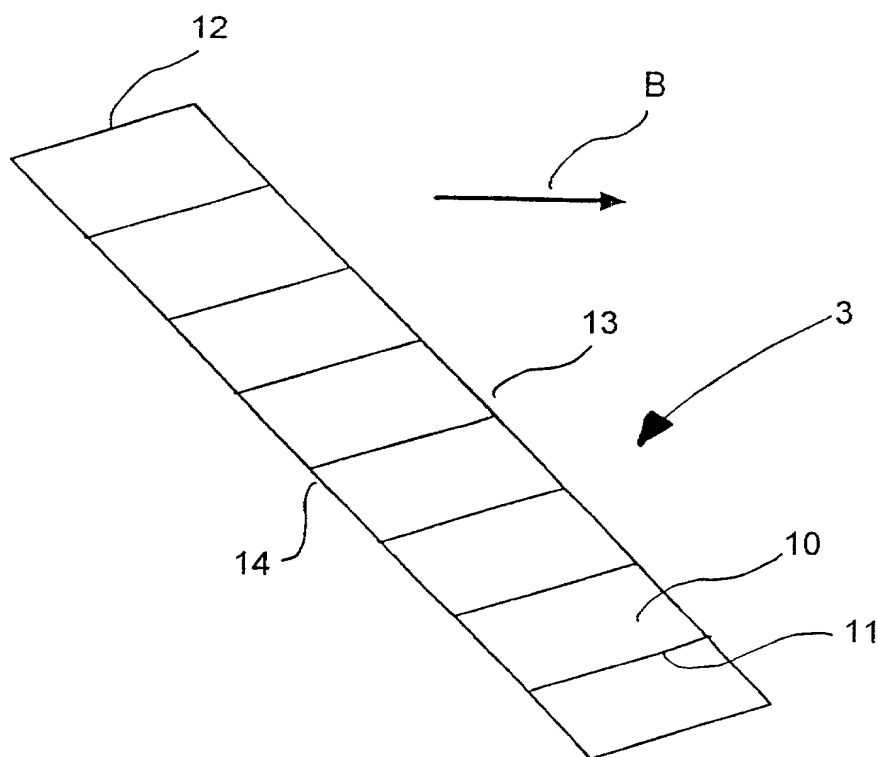


Fig. 5

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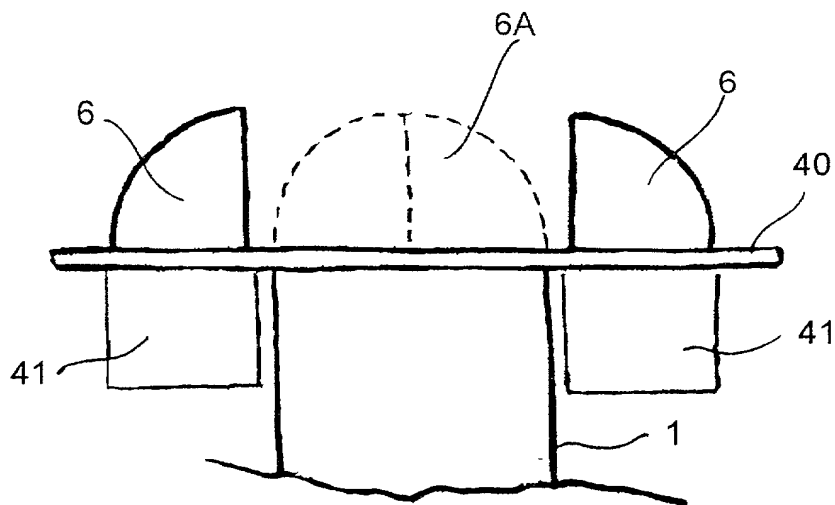


Fig. 6

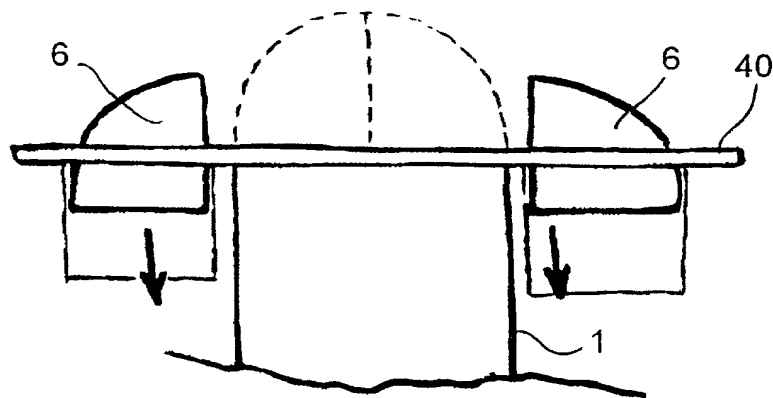


Fig. 7

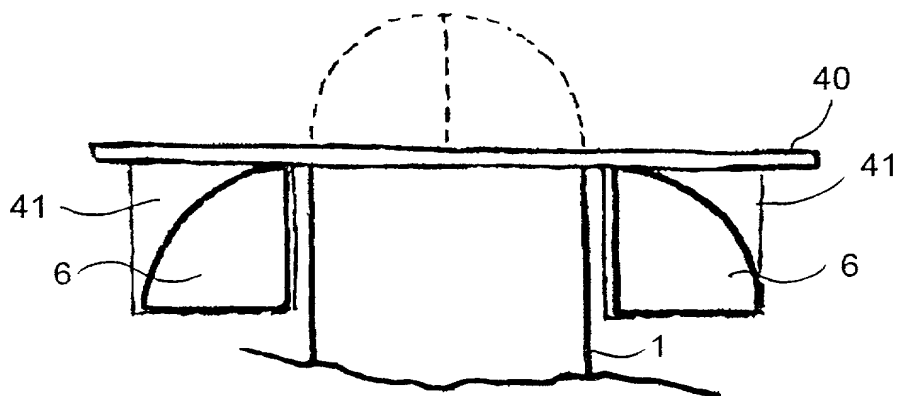


Fig. 8

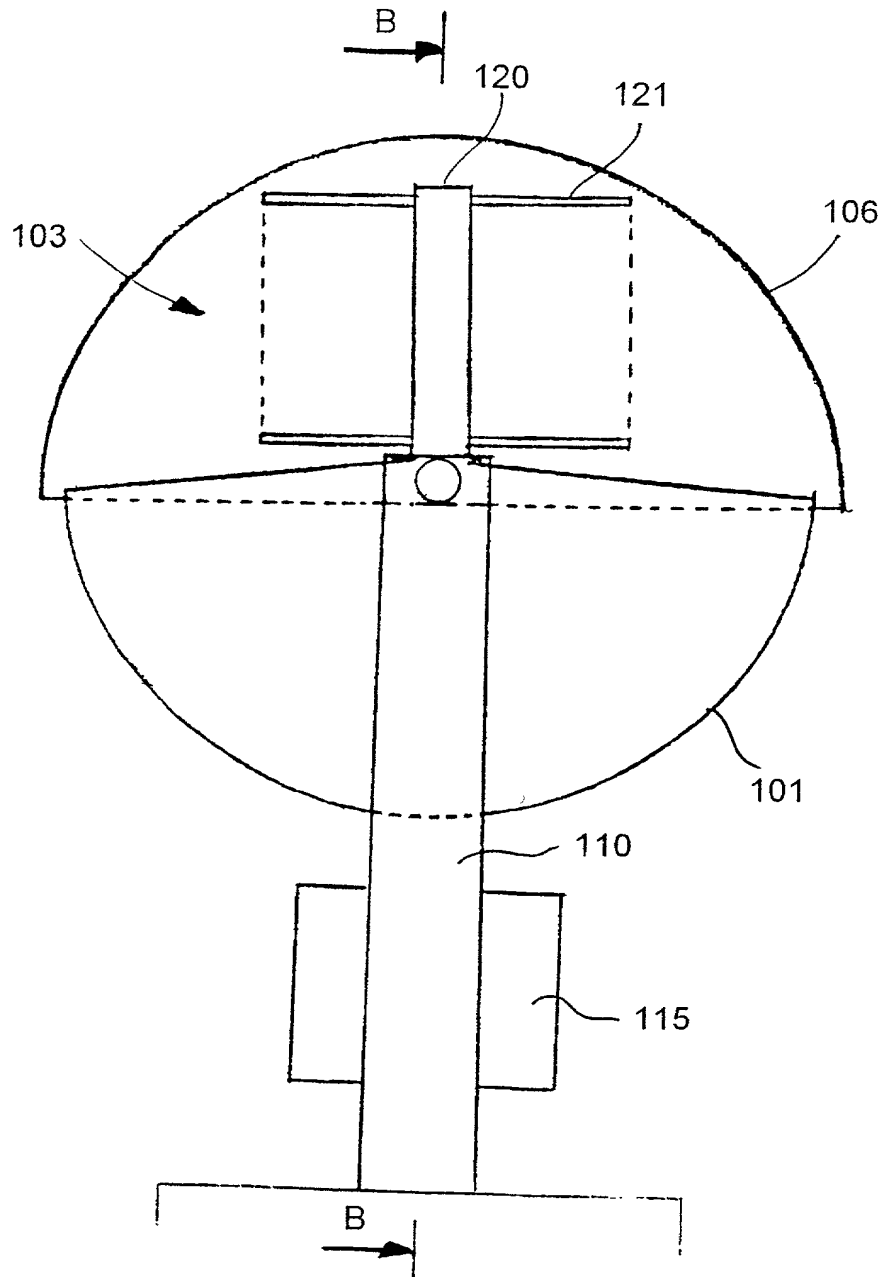


Fig. 9

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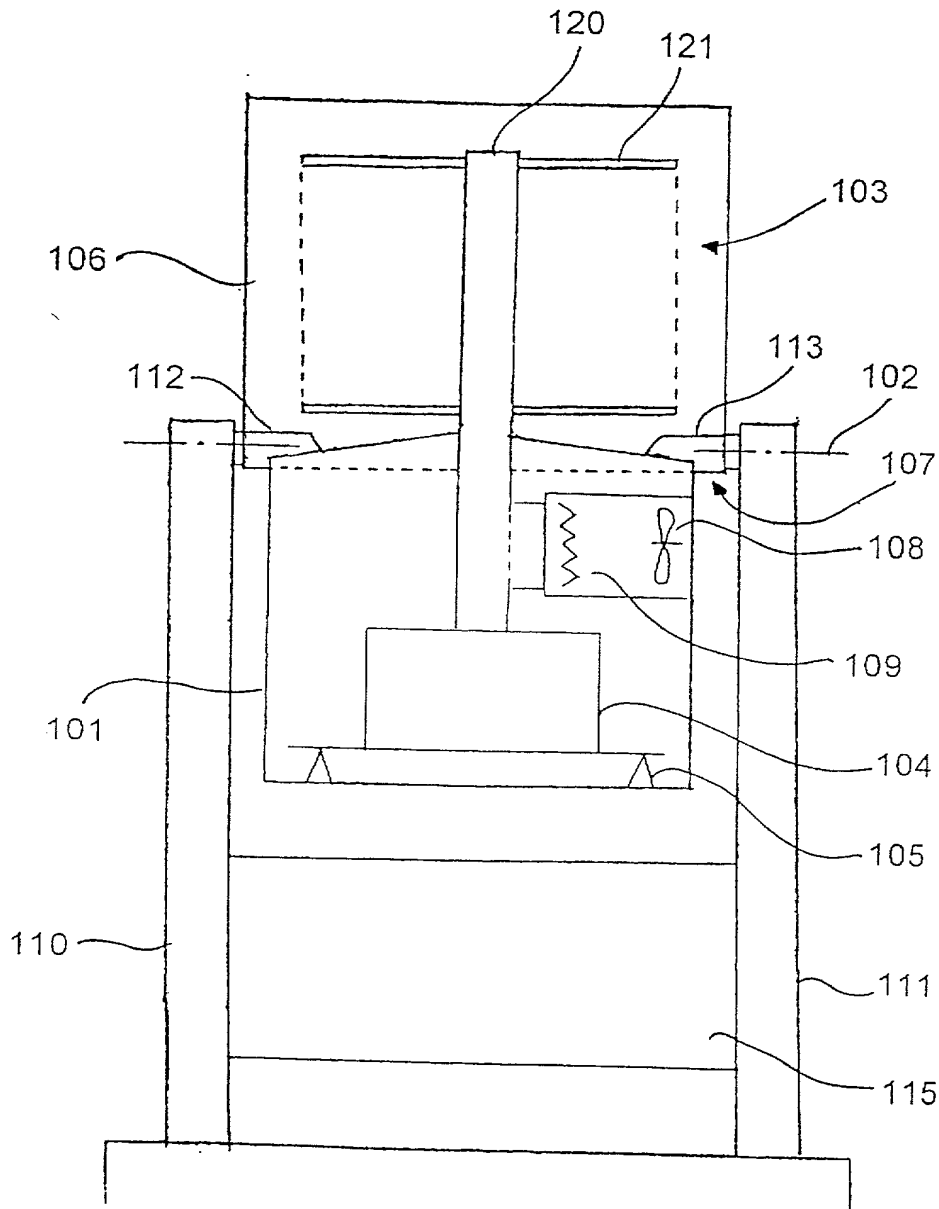


Fig. 10

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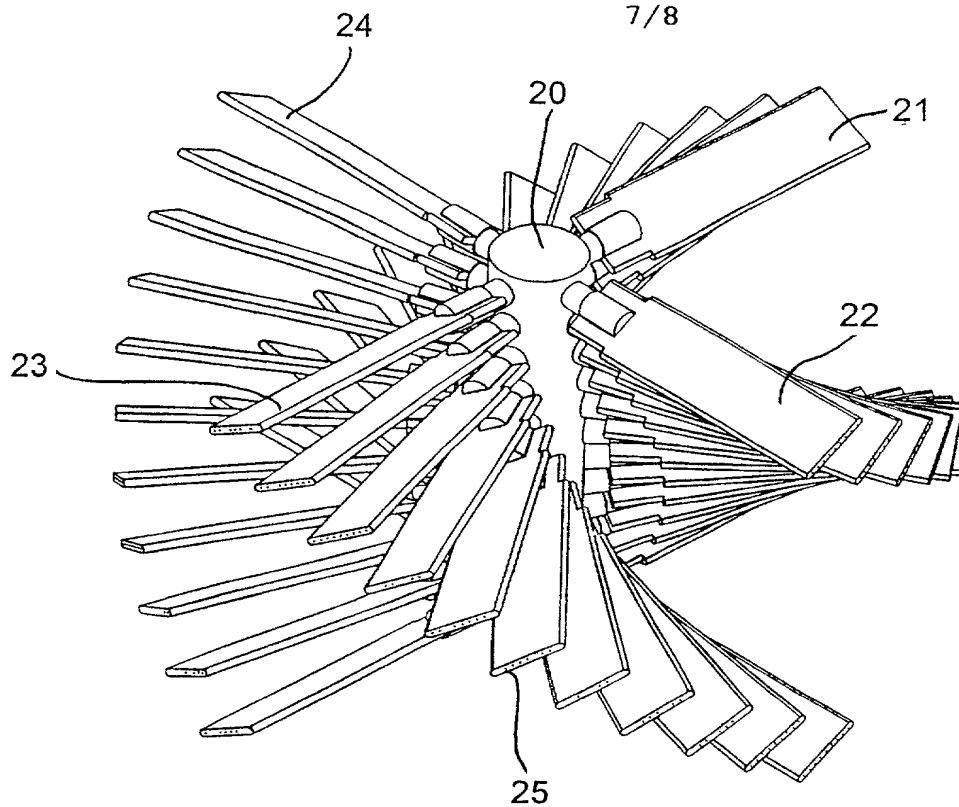


Fig. 11

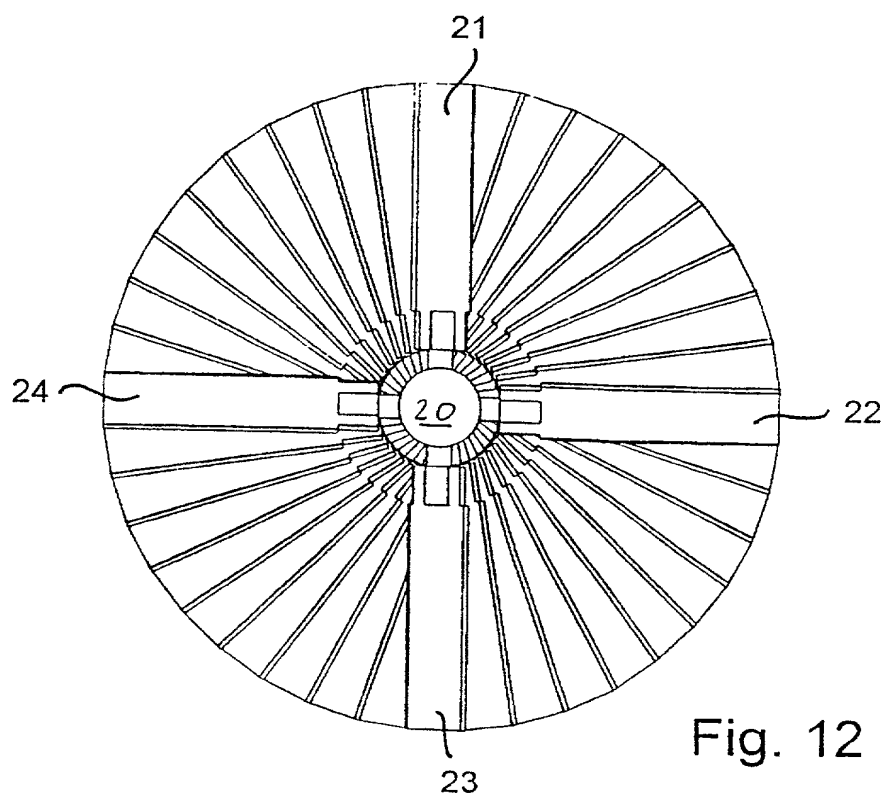


Fig. 12

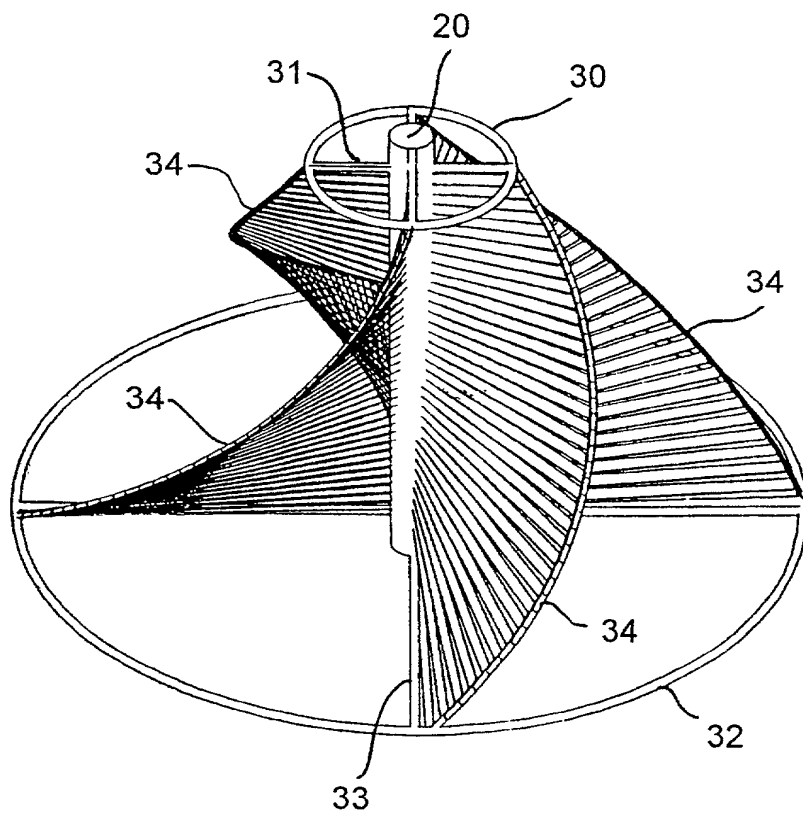


Fig. 13

COMBINED DECLARATION AND POWER OF ATTORNEY FOR UTILITY PATENT APPLICATION (Includes PCT)

Attorney Docket No.

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name; that

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural inventors are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

A method and an apparatus for measuring icing

the specification of which (check one): ☐ is attached hereto.

☐ was filed on _____ as Application Serial No. _____ and was amended on _____.

☒ was filed as PCT international application no. PCT/ DK00/00094 on March 7, 2000 and was amended under PCT Article 19 on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, §1.56(a).

I do not know and do not believe the claimed invention was ever known or used in the United States of America before my or our invention thereof, or patented or described in any printed publication in any country before my or our invention thereof or more than one year prior to this application, that the same was not in public use or on sale in the United States of America more than one year prior to this application, that the invention has not been patented or made the subject of an inventor's certificate issued before the date of this application in any country foreign to the United States of America on an application filed by me or my legal representatives or assigns more than twelve months prior to this application.

I hereby claim foreign priority benefits under Title 35, United States Code §119 of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application(s) on which priority is claimed:

Prior Foreign Application(s)

Priority Claimed

PA 1999 00323 08.03.1999 Denmark
(Number) (Country) Day/Month/Year Filed

☒ ☐
Yes No

(Number) (Country) Day/Month/Year Filed

☐ ☐
Yes No

(Number) (Country) Day/Month/Year Filed

☐ ☐
Yes No

I hereby claim the benefit under Title 35, United States Code, §119 (e) of any United States provisional application(s) listed below:

Application No. Day/Month/Year Filed

Application No.

Day/Month/Year Filed

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s) or PCT international application(s) designating the United States of America listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior application(s) in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose material information as defined in Title 37, Code of Federal Regulations, §1.56(a) which occurred between the filing date of the prior application and the national or PCT international filing date of this application:

Attorney Docket No. _____

Application Serial No. _____ Filing Date _____ Status (patented, pending, abandoned) _____

Application Serial No. _____ Filing Date _____ Status (patented, pending, abandoned) _____

12- I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith: Lawrence R. Radanovic, Reg. No. 23,077; Richard H. Tushin, Reg. No. 27,297; Donald N. Huff, Reg. No. 27,561; John P. DeLuca, Reg. No. 25,505; Michael Bergman, Reg. No. 42,318; Sandra S. Snapp, Reg. No. 41,444; Charles Rutherford, Reg. No. 18,933; Robert L. Kelly, Reg. No. 31,843; Kevin M. Hinman, Reg. No. 35,193; Ernest E. Helms, Reg. No. 29,721; William F. Kolakowski, Reg. No. 41,908; and John F. Buckert, Reg. No. 44,572, all of Dykema Gossett PLLC. Direct all telephone calls to telephone no. (202) 522-8600 and faxes to (202) 522-8669.

Address all correspondence to Dykema Gossett PLLC, Suite 300 West, 1300 I Street, N.W., Washington, D.C. 20005-3306.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true, and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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Full Name of Second Joint Inventor	Inventor's Signature	Date
Residence:		Citizenship
Post Office Address:		
Full Name of Third Joint Inventor	Inventor's Signature	Date
Residence:		Citizenship
Post Office Address:		

INSTRUCTIONS

SMALL BUSINESS

VERIFIED STATEMENT (DECLARATION) CLAIMING SMALL ENTITY STATUS
(37 CFR 1.9(f) AND 1.27(c)) - SMALL BUSINESS CONCERN

I hereby declare that I am

- Check one ☒ a) (x) the owner of the small business concern identified below:
☐ b) () an official of the small business concern empowered to act on behalf of the concern identified below:

Insert company

name and

address

NAME OF CONCERN: Dalsgaard Nielsen ApSADDRESS OF CONCERN: Holmevej 35, DK-9640 Farsø, DENMARK

I hereby declare that the above identified small business concern qualifies as a small business concern as defined in 13 CFR 121.12, and reproduced in 37 CFR 1.9(d), for purposes of paying reduced fees under section 41(a) and (b) of Title 35, United States Code, in that the number of employees of the concern, including those of its affiliates, does not exceed 500 persons. For purposes of this statement, (1) the number of employees of the business concern is the average over the previous fiscal year of the concern of the persons employed on a full-time, part-time or temporary basis during each of the pay periods of the fiscal year, and (2) concerns are affiliates of each other when either, directly or indirectly, one concern controls or has the power to control the other, or a third party or parties controls or has the power to control both.

Insert title of

application,

inventor's

names

- I hereby declare that rights under contract or law have been conveyed to and remain with the small business concern identified above with regard to the invention, entitled A METHOD AND AN APPARATUS FOR MEASURING ICING by inventor(s) NIELSEN, Evan described in

Check one,

fill in if

b) or c)

- ☐ a) () the specification filed herewith.
☒ b) (x) application serial no. PCT/DK00/00094, filed March 7, 2000.
☐ c) () patent no. _____, issued _____.

If the rights held by the above-identified small business concern are not exclusive, each individual, concern or organization having rights to the invention is listed below and no rights to the invention are held by any person, other than the inventor, who could not qualify as an independent inventor under 37 CFR 1.9(c), if that person had made the invention, or by any concern which would not qualify as a small business concern under 37 CFR 1.9(d) or a nonprofit organization under 37 CFR 1.9(e). **NOTE:** Separate verified statements are required from each named person, concern or organization having rights to the invention averring to their status as small entities. (37 CFR 1.27)

Insert co-owners,

if any, and check

a), b) or c)

NAME _____
 ADDRESS _____
☐ a) () INDIVIDUAL ☐ b) () SMALL BUSINESS CONCERN ☐ c) () NONPROFIT ORGANIZATION

NAME _____
 ADDRESS _____
☐ a) () INDIVIDUAL ☐ b) () SMALL BUSINESS CONCERN ☐ c) () NONPROFIT ORGANIZATION

I acknowledge the duty to file, in this application or patent, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate. (37 CFR 1.28(b))

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereof, or any patent to which this verified statement is directed.

Insert

Sign, date

☒ NAME EVAN NIELSEN
 TITLE _____
 ADDRESS Holmevej 35, 9640 FARSØ DENMARK
☒ SIGNATURE Evan Nielsen DATE 19.10.2001